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**Women—Particularly Underrepresented Minority Women—and Early-Career Academics  
Feel Like Impostors in Fields that Value Brilliance**

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### Abstract

Feeling like an impostor is common among successful individuals, but particularly among women and early-career professionals. Here, we investigated how gender and career-stage differences in impostor feelings vary as a function of the *contexts* that academics have to navigate. In particular, we focused on a powerful but underexplored contextual feature: the extent to which raw intellectual talent (“brilliance”) is prized in an academic field. We hypothesized that gender and career-stage differences in impostor feelings would be magnified in fields that value brilliance. We tested this hypothesis using the largest sample of academics that has been brought to bear on the impostor phenomenon to date, with over 4,000 academics recruited from 9 research-intensive U.S. universities and representing more than 80 fields across the natural and social sciences, the humanities, and medicine. Consistent with our hypothesis, the more that success in a field was perceived to require brilliance, the more that women—especially women from racial/ethnic groups that are traditionally underrepresented in academia—and early-career academics felt like impostors. Impostor feelings were also related to a lower sense of belonging in a field and lower self-efficacy, highlighting the potential negative implications of the impostor phenomenon for academics’ long-term success and for the diversity of fields that value brilliance.

**Keywords:** impostor phenomenon, gender, academia, belonging, self-efficacy

### **Educational Impact and Implications Statement**

Feeling like an impostor is common among academics, but the burden of feeling like an impostor is not distributed evenly: Women and early-career scholars are particularly likely to feel like frauds in their professional lives. Using the largest sample of academics that has been brought to bear on this phenomenon to date (with over 4,000 academics representing more than 80 fields), the present research uncovers a feature of academic settings that relates systematically to the magnitude of these differences: We found that the more a field was perceived to require “raw talent” for success, the more women (especially women from racial/ethnic groups that are traditionally underrepresented in academia) and early-career academics felt like impostors. These findings highlight the substantial extent to which impostor experiences are a function of the contexts that people must navigate rather than being a symptom of inherent psychological vulnerabilities.

### **Women—Particularly Underrepresented Minority Women—and Early-Career Academics Feel Like Impostors in Fields that Value Brilliance**

Many high-achieving individuals feel intellectually inadequate despite objective proof of their competence and success. This so-called *impostor phenomenon* (Clance & Imes, 1978) has several components but generally refers to a feeling of “intellectual fraudulence.” That is, individuals who experience impostor feelings regard their success as unearned, and these feelings are often accompanied by doubts about succeeding in future endeavors (Clance, 1985a; Harvey & Katz, 1985). Impostor feelings take a toll on individuals’ ability to succeed in the long term (Clance, 1985a; Clance & Imes, 1978) and are distinct—both as a phenomenon and in their effects—from other psychological phenomena such as depression, low self-esteem, or social anxiety (Chrisman et al., 1995). A key conclusion of prior research on the impostor phenomenon is that its prevalence differs across demographic groups. In particular, multiple studies over the last few decades have documented that women are more likely to feel like impostors than men (e.g., Ivie et al., 2016; Jöstl et al., 2015; King & Cooley, 1995), and recent evidence reveals a similar difference between early-career academics and their more senior colleagues (Vaughn et al., 2020).

Describing these demographic differences is undoubtedly important, but it is at least as important to investigate the contexts in which they arise. A person’s experiences, including the extent to which they feel psychologically “safe,” are in large part a function of the situations they have to navigate (e.g., Murphy et al., 2018; Schmader & Hall, 2014). Without attention to this dimension, highlighting group differences in impostor feelings may implicitly signal that these feelings are unavoidable for women and early-career individuals. Thus, our main goal here was to investigate the *contextual dimension* of the observed demographic differences in the prevalence of the impostor phenomenon (e.g., Feenstra et al., 2020). We focused this investigation on academia because its emphasis on perceived intellect makes the experience of

feeling like an intellectual fraud a particularly common one (e.g., Cokley et al., 2017; Ivie et al., 2016; Jöstl et al., 2015; Peteet et al., 2015; Vaughn et al., 2020). To arrive at a comprehensive understanding of how demographic differences in the impostor phenomenon vary across contexts, we recruited the largest sample of academics that has been brought to bear on this phenomenon to date, with over 4,000 academics representing more than 80 fields across nine U.S. universities.

Multiple aspects of an academic context may be relevant to whether its members feel like impostors. Here, we focused on an aspect that has not been examined in this literature but that may be a powerful source of impostor feelings: the extent to which a field values raw intellectual “firepower,” or brilliance. Some fields more than others emphasize to their members that brilliance is a necessary ingredient for professional success (Ito & McPherson, 2018; Leslie et al., 2015; Meyer et al., 2015; Storage et al., 2016). Messages about brilliance, whether explicit or implicit, are common in many fields in science, technology, engineering, and mathematics (STEM), but also in fields outside of STEM, such as philosophy or economics (Leslie et al., 2015). Because the impostor phenomenon is marked by concerns about perceived competence, environments where intellectual brilliance or giftedness is seen as a requirement for success may prompt concerns about having “the right stuff” to succeed (e.g., Muenks et al., 2020), putting academics at increased risk of impostor feelings.

Relevant to our goal of understanding *differences* in impostor feelings, a field’s emphasis on brilliance may not affect everyone equally. First, impostor concerns may be heightened in brilliance-oriented fields among academics from social groups that are not culturally associated with intellectual giftedness. Because women are targeted by such stereotypes (e.g., Bian et al., 2017; Bian, Leslie, & Cimpian, 2018; Storage et al., 2020), they may be particularly likely to worry about whether they “have what it takes” to do well in brilliance-oriented fields, and about whether their peers and colleagues think they do (e.g., Bian, Leslie, Murphy, & Cimpian, 2018). That is, we expected that women would experience heightened impostor feelings relative to

men in brilliance-oriented fields. Second, impostor concerns may be heightened in brilliance-oriented fields among early-career academics, who may feel more uncertain about their abilities and experience more pressure to “prove” them. While concerns about one’s abilities may be relatively common among early-career academics regardless of setting or field (Vaughn et al., 2020), the environment of brilliance-oriented fields is likely to exaggerate them.

The size and breadth of the sample of academics recruited for this project also enabled us to adopt an *intersectional perspective* (e.g., Crenshaw, 1991) on the impostor phenomenon. Although women’s and men’s experiences in professional contexts differ meaningfully depending on their racial/ethnic identities (e.g., Berdahl & Moore, 2006; Purdie-Vaughns & Eibach, 2008), as do gender stereotypes (e.g., Ghavami & Peplau, 2013; Jaxon et al., 2019), prior work on the impostor phenomenon has not taken these intersections into account. We considered two ways in which information about academics’ race/ethnicity (specifically, their membership in a racial/ethnic minority group that is traditionally underrepresented in academia [URM]) could enrich our prediction that gender differences in impostor feelings are larger in brilliance-oriented fields. According to an “additive model” (e.g., Juan et al., 2016; Purdie-Vaughns & Eibach, 2008)—which assumes that each social identity brings a distinct and separable contribution to the individual’s experiences—we would expect URM women’s and men’s impostor experiences in brilliance-oriented fields to resemble the sum of impostor feelings experienced by their gender group (as a generic category) and their racial/ethnic group (as a generic category). In contrast, according to an “interactive model” (e.g., Purdie-Vaughns & Eibach, 2008)—which assumes that a person’s social identities merge together to form a new, qualitatively distinct whole—we would instead expect URM women’s and men’s impostor experiences in brilliance-oriented fields to depart from the pattern expected from simply considering the “main effects” of gender and URM status. For instance, URM women might experience levels of impostor phenomenon that exceed the sum of the separate gender- and URM-based differences in the sample.



As these considerations make clear, the focus of the present research on fields' emphasis on brilliance is not only theoretically motivated but also relevant to ongoing efforts to diversify academia. Brilliance-oriented fields tend to be less diverse, with fewer women and fewer URMs obtaining bachelor's and doctoral degrees in these fields, both in STEM and in the social sciences and humanities (Ito & McPherson, 2018; Leslie et al., 2015; Storage et al., 2016). If women and URMs pursuing these fields experience heightened impostor feelings due to cultural stereotypes about brilliance, they may thereby be at a disadvantage relative to their peers, which may explain these fields' diversity problem. Thus, the results of the present research can inform future interventions to increase the diversity of brilliance-oriented fields by revealing one of the ways in which their emphasis on raw intellect makes success feel (and, as a result, perhaps actually be) less attainable for members of underrepresented groups.

A final goal of this research was to identify *how* the impostor phenomenon may limit the success of individuals affected by it. Past work has established links between the impostor phenomenon and a number of achievement-related variables, including maladaptive attributions for success (e.g., to luck) and failure (e.g., to lack of ability), lower interest in and enjoyment of academic work (Vaughn et al., 2020), heightened test anxiety, weaker mastery goals, and stronger performance goals (Kumar & Jagacinski, 2006). Here, we build off this work by investigating how the impostor phenomenon relates to two constructs that are well-established predictors of retention, persistence, and success in academia and in the workplace more generally: *belonging* (e.g., Cheryan et al., 2009; Hausmann et al., 2007; Phillips & Russel, 1994; Pittman & Richmond, 2007; Walton et al., 2012) and *self-efficacy* (Bandura, 1977, 1982; Pajares, 1996; Pajares & Johnson, 1996; Schunk, 1984, 1989).

Having a sense of belonging (that is, feeling socially connected with others) is a fundamental psychological need (Baumeister & Leary, 1995; Maslow, 1968) that has been linked with multiple aspects of motivation, including interest (Bian, Leslie, Murphy, & Cimpian, 2018; Cheryan et al., 2009) and persistence (Hausmann et al., 2007; Walton et al., 2012). In

fact, large-scale interventions that increased students' sense of belonging at critical junctures in their educational careers, such as the transition to college, reduced the probability of dropping out during the first year of college for disadvantaged students and improved their first-year grade point averages (GPAs; Yeager et al., 2016). Similarly, self-efficacy relates to a number of achievement-related behaviors. For instance, individuals who feel self-efficacious put in more effort on tasks and show greater persistence, especially when faced with challenges (Bandura, 1977, 1982; Schunk 1984, 1989). Over the longer term, self-efficacy predicts important outcomes such as career choice and attainment (e.g., Cheryan et al., 2017; Lauermann et al., 2017). We expected that impostor feelings would be accompanied by doubts about one's belonging and by lower self-efficacy. In addition, we explored whether these relationships are stronger for some groups (e.g., women, URMs, early-career academics) than for others, which would also work against diversifying brilliance-oriented fields and would have implications for diversity initiatives.

To summarize, the present research aims to make three contributions to our understanding of the impostor phenomenon. First, it investigates *contextual variation* in the previously observed demographic differences in the prevalence of impostor feelings. Rather than pathologizing individuals or groups who experience the impostor phenomenon, we test the possibility that group differences in the prevalence of these feelings emerge in particular contexts—specifically, in fields that place a high premium on brilliance. Second, this research brings an *intersectional perspective* to the study of gender differences in impostor feelings, capitalizing on the size and breadth of our sample to investigate how differences in women's vs. men's impostor experiences across fields vary as a function of their race/ethnicity. Third, this research adds to our understanding of how the impostor phenomenon may impede academics' success by investigating the relation between impostor feelings and academics' sense of *belonging* and *self-efficacy*, both of which are crucial to long-term success in academic settings. We pursued these three aims with a sample of 4,870 academics at multiple career stages

(graduate students, postdoctoral fellows, and faculty) in more than 80 fields, including those in STEM, the humanities and social sciences, and the medical and health sciences.

### **Method**

This study was approved by New York University's Institutional Review Board. Current ethical standards were followed in the conduct of the study, and informed consent was obtained from all participants in the dataset.

### **Open and Transparent Scientific Practices**

All data and analytic syntax needed to reproduce the analyses reported here are available on the Open Science Framework (OSF):

[https://osf.io/b3drt/?view\\_only=f8ccf83723414e7fbca8d05a14775c35](https://osf.io/b3drt/?view_only=f8ccf83723414e7fbca8d05a14775c35). The OSF repository also contains the Qualtrics survey that was administered to academics.

### **Participants**

Academics from nine public and private U.S. universities received an email invitation to complete an anonymous survey in exchange for a \$5 Amazon.com gift card. In selecting the nine universities, we first narrowed the sampling frame by considering only (1) universities that have a medical school, since one of the goals of this study was to have as broad a sample of fields as possible; (2) universities that are research-intensive (Research 1 or R1; The Carnegie Classification of Institutions of Higher Education, n.d.), since we estimated that a survey examining impostor feelings would be particularly applicable to academics working in research-intensive environments; (3) universities that are in the top 100 in the U.S. as ranked by U.S. News & World Report, for the same reason as criterion #2; and (4) universities that were not targeted by Leslie et al. (2015), both to avoid interference from this previous study and to broaden the investigation of brilliance perceptions. Because we were targeting postgraduates and hoped to obtain a large sample, we also consulted postgraduate enrollment numbers and targeted universities with at least ~10,000 postgraduates. From a short list, we selected at least two universities from each region of the U.S. (Northeast, Midwest, South, West), and we

balanced the sample in terms of public vs. private universities. To preserve participants' anonymity, we do not disclose which universities were in the final sample.

Next, we obtained publicly available email addresses for graduate students, postdoctoral fellows, and professors from university websites. Participants received an initial email with an invitation to participate in the survey (see Table S1 in the Supplementary Online Materials [SOM]). Academics who did not participate in the survey were emailed two reminders: the first one week after the initial email and the second two weeks after the initial email (see Table S1). We targeted academics from 67 fields: 30 fields in the social sciences, humanities, and STEM and 37 fields in the medical and health sciences (see Table S2). All academics whose email addresses were listed on their universities' websites for these departments were contacted. Participants who did not find their field among the 67 options listed were allowed to type in the name of their field; we grouped these open-ended responses to create additional fields beyond those initially targeted by the survey (e.g., agriculture, architecture), for a total of 83 fields (see Table S3). Data were collected between June 2017 and April 2018.

In total, we emailed 46,304 academics and obtained consent from 5,305. Thus, the response rate was 11.5%. However, we excluded participants who indicated that they were staff ( $n = 70$ ) or undergraduate students ( $n = 2$ ). From the remaining sample of 5,233 academics, participants who did not indicate their field ( $n = 87$ ) or indicated a field that was not present on our final list of fields (see Table S3;  $n = 27$ ) were not included in any analyses. Additionally, participants who did not complete at least 3 of the 5 items for the impostor phenomenon measure ( $n = 341$ ) were likewise not included in any analyses.<sup>1</sup> Thus, the final analytic sample comprised 4,870 academics. For all statistics and analyses presented below, we used this sample of 4,870 participants.

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<sup>1</sup> These counts are overlapping. That is, participants were included in the counts for any criterion they failed, and some participants failed multiple criteria. For this reason, summing across the exclusion criteria and the final sample (4,870) adds to more than 5,233.

Within this analytic sample, participants who did not complete at least 4 of the 8 field-specific ability beliefs (FAB) items ( $n = 71$ ), at least 4 of the 8 items in the belonging measure ( $n = 26$ ), or at least 3 of the 5 items in the self-efficacy measure ( $n = 27$ ) were not included in the analytic models that involved these variables. Data from academics who did not indicate their gender ( $n = 149$ ), race/ethnicity ( $n = 211$ ), position ( $n = 143$ ), or selected “other” for these three questions were not included in analytic models that involved these variables. (If participants selected “other” but then wrote in a description that rendered their response usable [e.g., “Male”, “Latino”, “Non-tenure-track faculty”], we classified their response accordingly and retained them in analytic models.)

The final analytic sample comprised graduate students, postdoctoral fellows, medical residents, and faculty across 83 fields in STEM, the social sciences, the humanities, medicine, and the health sciences. Participants were 51% female and 49% male. Participants were categorized as a member of an underrepresented minority if they self-identified as at least one of the following: Hispanic or Latino/a, American Indian or Alaska Native, Black or African American, or Native Hawaiian or Other Pacific Islander. Participants who self-identified as only Non-Hispanic White, Asian, or both were classified as a non-underrepresented minority. Non-underrepresented minorities (non-URMs) comprised 89% of the total sample, and underrepresented minorities (URMs) comprised 11% of the total sample. Finally, participants were 61% non-faculty (graduate students, postdoctoral fellows, and medical residents) and 39% faculty (tenured, tenure-track, and non-tenure-track faculty). More specifically, the sample comprised 50% graduate students, 39% faculty, 7% postdoctoral fellows, and 4% medical residents.

### **Survey Administration and Content**

After participants provided consent, they were asked to indicate whether their current primary affiliation at their university was best described as non-medical or medical (see the Qualtrics survey in the OSF repository). Next, participants were asked to select their discipline

among 30 options (or they could select “Other” and type in the name of their discipline) if they indicated that their affiliation was non-medical or among 37 options if they indicated that their affiliation was medical. Participants were asked to indicate a subdiscipline as well if they selected one of the following as their discipline: Engineering, Pediatrics, Family Medicine, and Internal Medicine.

Participants then completed questionnaires about impostor feelings, belonging, and self-efficacy (see Table 1 for items and Table 2 for correlation matrix). These three questionnaires, and the items within each questionnaire, were presented in random order. Participants were asked to respond to these items with respect to their current field. Afterward, participants filled out the questionnaire assessing their perceptions of their field’s brilliance orientation (i.e., FAB) and completed demographic information (see Table S4). At the end of the survey, participants were directed to a separate survey (to preserve their anonymity) and asked to enter their email address to receive payment in the form of a \$5 Amazon.com gift card. No measures other than the ones listed above (and described below) were administered.

### ***Impostor Phenomenon***

To assess academics’ impostor feelings, we asked them to complete a shortened version of Clance’s Impostor Phenomenon scale (CIPS; Clance, 1985b). We used a total of five items, presented in random order (e.g., “I’m afraid people important to me may find out that I am not as capable as they think I am”; see Table 1 for full list). Participants rated their agreement with these items on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). We computed a single impostor phenomenon score for each participant by averaging these five items ( $\alpha = .93$ ). Higher scores indicated stronger impostor feelings (see Table S5 for averages by field).

The use of a shortened version of the original CIPS scale (as well as of the other scales below) was intended to maximize the completion rate of the study, as well as keep its length to five minutes—the length advertised to participants. The shorter scale was created as follows:

We first excluded from consideration four of the original 20 items because they were found to have undesirable psychometric properties in prior work (Ketrav et al., 1992; see also French et al., 2008). To determine which of the remaining 16 items to retain, we administered them to a pilot sample of academics from two universities other than those included in the main sample. We then performed an exploratory factor analysis with principal factors extraction on these data. A parallel analysis (Horn, 1965) suggested retaining as many as 10 different factors. However, the adjusted eigenvalues were 7.57 for the first factor and between 1.03 and 0.47 for factors 2–10 (that is, considerably smaller). In addition, all 16 items had loadings  $> .52$  on the first (unrotated) factor. Thus, a unifactorial solution seemed most sensible, consistent with what others have found (Jöstl et al., 2012; Simon & Choi, 2018). We selected the five items that had the highest loadings on the first (unrotated) factor. The mean of these five items correlated with the mean of all 16 items at 0.94 ( $p < .001$ ) and with the mean of the other 11 items at 0.85 ( $p < .001$ ).

### ***Belonging***

To assess academics' feelings of belonging, we asked them to complete an adapted and shortened version of the Sense of Belonging to Math Scale (Good et al., 2012). We used a total of eight items, presented in random order (e.g., "I feel accepted by other members of my field"; see Table 1). Participants rated their agreement with these items on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Two of these items were reverse scored. We computed a single belonging score for each participant by averaging these eight items ( $\alpha = .90$ ), with higher scores reflecting a stronger sense of belonging.

### ***Self-efficacy***

To measure academics' sense of self-efficacy, we asked them to complete an adapted and shortened version of the New General Self-Efficacy Scale (Chen et al., 2001). Participants rated their agreement with five items, presented in random order (e.g., "I believe I can succeed at almost any professional endeavor to which I set my mind"; see Table 1). Participants rated

their agreement with these items on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). We computed a single self-efficacy score for each participant by averaging these five items ( $\alpha = .90$ ), with higher scores reflecting a stronger sense of self-efficacy.

### ***Fields' Brilliance Orientation***

To assess academics' beliefs about the extent to which brilliance is required for success in their field, we asked them to complete an eight-item field-specific ability beliefs (FAB) questionnaire (Leslie et al., 2015; see Table 1). Participants were asked only about their own field (e.g., psychologists only answered questions about psychology). Two items concerned the degree to which brilliance and giftedness were required for success in their field (e.g., "I think that being a top scholar of [my discipline] requires a special aptitude that just can't be taught"; 1 = *strongly disagree* to 7 = *strongly agree*), and two concerned the degree to which effort and hard work were sufficient for success in their field (e.g., "I think that with the right amount of effort and dedication, anyone can be a top scholar of [my discipline]"; reverse-coded). Four items asked participants to report their own beliefs, and four items asked participants to report the beliefs of other academics in their field, for a total of eight items. The four items asking participants to report their own beliefs were presented together as a block, as were the four items about the beliefs of others in the field; the orders of the two blocks and of the four items within each block were randomized. We computed each participant's FAB score by reverse scoring the items about effort and then averaging all eight items ( $\alpha = .80$ ). (The items rated from respondents' own perspective and those rated from the perspective of others in their field had similar relationships with impostor feelings [see Models 1 and 2 in Table S9].) Higher scores indicated a stronger perceived emphasis on brilliance.

### **Analytic Strategy**

We fit mixed-effects linear models using the *lme4* package (version 1.1-26; Bates et al., 2015) in R version 3.6.0. We obtained *p* values using the *lmerTest* package (version 3.1-3; Kuznetsova et al., 2014). All models were fit using the default estimation method: restricted



maximum likelihood. All models included a random intercept for field. Following current guidelines, we identified which random slopes to include in each model (at the level of the field) by using likelihood ratio tests to compare the fit of nested models that differed in their random effects structure (Hox et al., 2018; see Appendix S1 in the SOM for additional details). For most models, this procedure suggested including only an uncorrelated random slope for gender. We report 95% confidence intervals for all coefficients below. Predicted marginal effects and means were computed using the *margins* (version 0.3.26; Leeper, 2018) and *effects* (version 4.2-0; Fox & Hong, 2009) packages respectively, and Johnson-Neyman intervals (Johnson & Fay, 1950) were computed using the *interactions* package (version 1.1.3; Long, 2019).

## Results

### Preliminary Results: Replicating Differences by Gender and Career Stage

We first fit a mixed-effects model that included participants' gender, URM status, and career stage, plus all possible interactions, as predictors of impostor feelings. The model also included a random intercept for field and an uncorrelated random slope for gender. Replicating previous reports of gender differences (e.g., Kumar & Jagacinski, 2006), women reported stronger impostor feelings than did men ( $M_s = 4.21$  and  $3.81$ , respectively, on a scale from  $1 = \text{strongly disagree}$  to  $7 = \text{strongly agree}$ , with  $4 = \text{neither agree nor disagree}$ ),  $b = 0.42$  [ $0.31, 0.52$ ],  $p < .001$ , a difference that amounts to  $0.25$  standard deviations ( $SD_s$ ; see Model 1 in Table S7). In contrast, URM academics did not report significantly stronger impostor feelings than White and Asian academics ( $M_s = 4.13$  and  $4.00$ , respectively),  $b = 0.13$  [ $-0.01, 0.28$ ] (equivalent to  $0.08$   $SD_s$ ),  $p = .069$ . Finally, replicating prior results pertaining to career stage (Vaughn et al., 2020), graduate students and postdoctoral fellows reported significantly stronger impostor feelings than did faculty ( $M_s = 4.49$  and  $3.27$ , respectively),  $b = -1.23$  [ $-1.33, -1.13$ ] (equivalent to  $0.74$   $SD_s$ ),  $p < .001$ . Appendices S2 and S3 detail exploratory analyses that documented additional differences in impostor feelings among subgroups (e.g., faculty by rank) and among domains (e.g., STEM vs. medicine; see Figure S1). These preliminary results

indicate that, as others have found before, women and early-career academics experience heightened impostor feelings.

### **Aim 1: Examining Differences by Gender and Career Stage as a Function of Fields'**

#### **Brilliance Orientation**

Our first aim was to investigate the extent to which the observed demographic differences in the prevalence of academics' impostor feelings vary as a function of their fields' brilliance orientation. To do so, we added academics' perceptions of the extent to which their field values brilliance, plus all interactions with the other variables, to the preceding model. As before, we also included a random intercept for field and an uncorrelated random slope for gender in the model. (We will refer to this as the "main model" from now on.)

The model revealed that academics' perceptions of their field's brilliance orientation indeed moderated the magnitude of the reported gender differences in impostor feelings ( $b = 0.13 [0.04, 0.22]$ ,  $p = .006$ ; see Model 1 in Table 3), such that these differences were larger at higher levels of emphasis on brilliance (see Figure 1). The estimated gender differences in impostor feelings at 1 *SD* below and above the average brilliance orientation score were  $bs = 0.29 [0.16, 0.42]$  (equivalent to 0.17 *SDs*) and  $0.54 [0.41, 0.68]$  (equivalent to 0.33 *SDs*),  $ps < .001$ , respectively. In addition, Johnson-Neyman intervals (Johnson & Fay, 1950) indicated that the differences between women and men in reported impostor feelings were statistically significant at all values of a field's perceived brilliance orientation higher than 2.12 (possible range = 1–7; see Figure 1).

We also unpacked this interaction by examining the relationship between academics' impostor feelings and the perceived brilliance orientation of their field separately by gender. This relationship was significant for women but not men (see Figure 1). A 1 *SD* increase in the perceived brilliance orientation of one's field corresponded to a 0.11 *SD* increase in impostor feelings for women ( $b = 0.18 [0.12, 0.24]$ ,  $p < .001$ ). In contrast, men's feelings of being an impostor did not vary as a function of their field's brilliance orientation ( $b = 0.06 [-0.01, 0.12]$ ,  $p$

= .079).

[Insert Figure 1 here]

Next, we examined whether the differences by career stage in the prevalence of the impostor phenomenon were also moderated by the extent to which fields value brilliance. The model revealed that, indeed, career-stage differences in impostor feelings were larger at higher levels of perceived emphasis on brilliance ( $b = -0.20 [-0.29, -0.11]$ ,  $p < .001$ ; see Figure 2). The estimated career-stage differences in impostor feelings at 1 *SD* below and above the average brilliance orientation score were  $bs = -1.05 [-1.18, -0.91]$  (equivalent to 0.63 *SDs*) and  $-1.44 [-1.57, -1.31]$  (equivalent to 0.87 *SDs*),  $ps < .001$ , respectively. Johnson-Neyman intervals (Johnson & Fay, 1950) indicated that the difference between early-career academics (graduate students and postdoctoral fellows) and faculty was significant at all values of a field's perceived brilliance orientation (see Figure 2).

Examining the relationship between academics' impostor feelings and the perceived brilliance orientation of their field separately by career stage, we found that this relationship was significant for early-career academics but not for faculty (see Figure 2). A 1 *SD* increase in the perceived brilliance orientation of one's field corresponded to a 0.12 *SD* increase in impostor feelings for graduate students and postdoctoral fellows ( $b = 0.20 [0.14, 0.26]$ ,  $p < .001$ ). In contrast, faculty members' impostor feelings did not vary as a function of their field's brilliance orientation ( $b = 0.003 [-0.07, 0.07]$ ,  $p = .93$ ).

Finally, we note that the slope difference between these two career stages was not significantly different for URM vs. non-URM (White and Asian) academics ( $b = 0.14 [-0.18, 0.45]$ ,  $p = .40$ ) or for women vs. men academics ( $b = 0.16 [-0.03, 0.34]$ ,  $p = .094$ ; see Figure S2 in the SOM).

[Insert Figure 2 here]

## **Aim 2: Applying an Intersectional Approach to Gender Differences in Impostor Feelings**

Our second aim was to apply an intersectional perspective to the impostor phenomenon. Consistent with this perspective, the main model (described in the preceding section) revealed a significant three-way interaction between perceptions of a field's brilliance orientation, academics' gender, and their URM status ( $b = 0.32$  [0.02, 0.62],  $p = .035$ ). Unpacking this interaction, we found that the gender differences in impostor feelings increased more sharply as a function of a field's perceived emphasis on brilliance for URM academics than for White and Asian academics (see Figure 3). For URM academics, the estimated gender differences in impostor feelings went from  $b = 0.16$  [-0.24, 0.56] (equivalent to 0.10 *SDs*),  $p = 0.44$ , at 1 *SD* below the average brilliance orientation score to as high as  $b = 0.94$  [0.54, 1.34] (equivalent to 0.57 *SDs*),  $p < .001$ , at 1 *SD* above—a nearly six-fold increase. In contrast, for White and Asian academics, these two estimated gender differences were closer in magnitude:  $bs = 0.30$  [0.16, 0.44] (equivalent to 0.18 *SDs*) and 0.49 [0.35, 0.63] (equivalent to 0.30 *SDs*),  $ps < .001$ , at 1 *SD* below and above the average brilliance orientation score, respectively.

An alternative way of interpreting this three-way interaction is to compare the gender differences in the relationship between a field's perceived brilliance orientation and reported impostor feelings for URM vs. non-URM academics. The difference between women and men in the strength of this relationship was larger for URM academics ( $b = 0.44$  [0.14, 0.74],  $p = .005$ ) than for non-URM (i.e., White and Asian) academics ( $b = 0.10$  [0.0004, 0.19],  $p = .050$ ; see Figure 3). The strongest relationship between perceptions of a field's brilliance orientation and reported feelings of being an impostor was found for URM women (see Figure 3, right panel). For this group, a 1 *SD* increase in the perceived brilliance orientation of one's field translated into a 0.18 *SD* increase in impostor feelings ( $b = 0.30$  [0.11, 0.49],  $p = .002$ ). In contrast, URM men's feelings of being an impostor did not vary with the perceived brilliance orientation of their

field ( $b = -0.11 [-0.33, 0.10]$ ,  $p = .31$ ). The corresponding slopes for non-URM women and men were  $b = 0.17 [0.10, 0.24]$ ,  $p < .001$ , corresponding to a 0.10 *SD* increase in impostor feelings for a 1 *SD* increase in brilliance orientation, and  $b = 0.08 [0.01, 0.15]$ ,  $p = .019$ , corresponding to a 0.05 *SD* increase in impostor feelings for a 1 *SD* increase in brilliance orientation, respectively (see Figure 3, left panel).

[Insert Figure 3 here]

### **Aims 1 and 2: Checking Whether the Results Are Robust**

The results above were robust across four alternative analyses. First, they replicated when we added the percentage of women and URMs in a field (see Appendix S1 and Table S6), as well as their interaction, as covariates in our model (for results, see Appendix S4 and Model 2 in Table 3). This robustness check speaks against the possibility that women's (and especially URM women's) stronger impostor feelings in brilliance-oriented fields were simply due to their underrepresentation in these fields. Second, the results above largely replicated when we added a set of post-stratification weights (see Appendix S1) to the model (for results, see Appendix S4 and Model 3 in Table 3). This robustness check suggests that our results were not substantially influenced by non-response bias—that is, differential response rates across subgroups of academics (e.g., Berg, 2005). Third, the results above replicated when we used multiple imputation to account for missing data (for results, see Appendix S4). Fourth, the results above replicated when we estimated model parameters with Bayesian model averaging (e.g., Hinne et al., 2020; Depaoli et al., 2020), which synthesizes parameter estimates across a range of plausible models rather than relying on a single “best” model (for results, see Appendix S4).

### **Aims 1 and 2: Using Field-Averaged Brilliance Orientation Scores**

So far, we have investigated how academics' impostor feelings vary as a function of their

own perceptions of whether their field values brilliance. However, we can also ask whether an individual academic's impostor feelings are predicted by whether *other members of their field* perceive it to value brilliance. For this analysis, we started with the main model above and simply replaced the variable tracking individuals' own perceptions of their field with a new variable tracking the average perceptions of everyone else in their field, excluding their own response from this average. To ensure that this average was sufficiently precise, we only used the 49 fields for which we had at least 20 respondents in our dataset ( $n = 4,346$ ). (The results below replicated when we used alternative thresholds, such as 15 or 25 respondents.) In this subset of the data, 7.3% of the variance in brilliance orientation scores was at the level of the field, and the reliability of the averaged perception variable was high,  $ICC(2) = .92$  (LeBreton & Senter, 2008; Lüdtke et al., 2009).

Relevant to our first aim, we again found that gender differences in the prevalence of impostor feelings were larger in brilliance-oriented fields ( $b = 0.42$  [0.07, 0.78],  $p = .024$ ; see Model 1 in Table S8). Career-stage differences did not vary with fields' brilliance orientation in this model, though ( $b = 0.02$  [-0.33, 0.36],  $p = .93$ ). The estimated career-stage differences in impostor feelings at 1 *SD* below and above the average (field-averaged) brilliance orientation score were  $bs = -1.22$  [-1.35, -1.08] (equivalent to 0.73 *SDs*) and  $-1.21$  [-1.36, -1.06] (equivalent to 0.73 *SDs*),  $ps < .001$ , respectively.

Relevant to our second aim, the three-way interaction between (field-averaged) perceptions of a field's brilliance orientation, gender, and URM status was not statistically significant in this model ( $b = 0.31$  [-0.75, 1.38],  $p = .57$ ). Although we again observed the largest gender differences in the impostor phenomenon among URM academics in fields that value brilliance (see below), the trajectories of these gender differences as a function of a field's emphasis on brilliance were more similar for URM and non-URM academics in this model, hence the null three-way interaction: For URM academics, the estimated gender differences in impostor feelings went from  $b = 0.41$  [-0.003, 0.82] (equivalent to 0.25 *SDs*),  $p = .052$ , at 1 *SD*

below the average (field-averaged) brilliance orientation score to  $b = 0.74$  [0.33, 1.15] (equivalent to 0.45  $SDs$ ),  $p < .001$ , at 1  $SD$  above. For White and Asian academics, the estimated gender differences in impostor feelings went from  $b = 0.30$  [0.16, 0.45] (equivalent to 0.18  $SDs$ ),  $p < .001$ , at 1  $SD$  below the average (field-averaged) brilliance orientation score to  $b = 0.53$  [0.38, 0.69] (equivalent to 0.32  $SDs$ ),  $p < .001$ , at 1  $SD$  above.<sup>2</sup> In the Discussion, we speculate about the reasons why participant-specific but not field-averaged brilliance orientation scores revealed evidence for the interactive (vs. additive) model of intersectionality.

As a robustness check, we tested whether the field-averaged perceptions of a field's brilliance orientation collected from a *different* sample of academics would predict the extent to which the academics in the *present* sample experience feelings of being an impostor. For this purpose, we used the data collected by Leslie, Cimpian, et al. (2015) from a sample of 1,820 academics working at a different set of U.S. universities than those surveyed here (see Appendix S1 in the SOM). The results of this model replicated those of the model with field-averaged brilliance orientation scores calculated from the present sample (compare Models 1 and 2 in Table S8).<sup>3</sup>

### **Aim 3: Examining the Relation Between the Impostor Phenomenon and Academics' Belonging and Self-Efficacy**

To address our third aim, we investigated how feelings of being an impostor relate to academics' belonging and self-efficacy. We examined this question with two mixed-effects models that differed only in whether belonging or self-efficacy served as the dependent variable. Each model included the following predictors and all possible interactions: participants' impostor

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<sup>2</sup> URM women again showed the strongest relationship between (field-averaged) perceptions of a field's brilliance orientation and impostor feelings (URM women:  $b = 0.96$  [0.23, 1.70],  $p = .010$ ; White and Asian women:  $b = 0.51$  [0.19, 0.82],  $p = .002$ ; URM men:  $b = 0.30$  [-0.43, 1.03],  $p = .42$ ; White and Asian men:  $b = 0.13$  [-0.12, 0.39],  $p = .31$ ).

<sup>3</sup> We also replicated Leslie, Cimpian, et al. (2015)'s main result: For the 30 fields included in their study, the field-averaged brilliance orientation scores calculated from the present sample were negatively correlated with female representation at the PhD level (as reported in NSF's Survey of Earned Doctorates),  $r(28) = -.37$ ,  $p = .047$ .

feelings, gender, URM status, and career stage. Each model also included a random intercept for field.

Results indicated that stronger feelings of being an impostor were indeed related to both a lower sense of belonging in one's field ( $b = -0.27 [-0.29, -0.26]$ ,  $p < .001$ ) and lower self-efficacy ( $b = -0.33 [-0.34, -0.31]$ ,  $p < .001$ ; see Tables 4 and 5). A 1 *SD* increase in reported impostor feelings corresponded to a 0.40 *SD* decrease in belonging and a 0.49 *SD* decrease in self-efficacy (see also Jöstl et al., 2015). These relationships were generally not moderated by gender, URM status, or career stage, with one exception: The negative relation between impostor feelings and self-efficacy was significantly stronger for graduate students and postdoctoral fellows ( $b = -0.34 [-0.37, -0.32]$ ,  $p < .001$ ) than for faculty ( $b = -0.30 [-0.32, -0.27]$ ,  $p < .001$ ; interaction:  $b = 0.05 [0.01, 0.08]$ ,  $p = .007$ ; see Tables 4 and 5 for robustness checks).

## Discussion

Feeling like an impostor is common among academics, but the burden of feeling like an impostor is not distributed evenly: Women and early-career scholars are particularly likely to feel like frauds in their professional lives. The present research uncovers a feature of academic settings that systematically predicts the magnitude of these differences. In a large sample of U.S. academics, we found that the more a field was perceived to require “raw talent” for success, the more women (especially women from racial/ethnic groups that are traditionally underrepresented in academia) and early-career academics felt like impostors. These findings, which were generally robust to alternative model specifications and estimation strategies, highlight the substantial extent to which the impostor phenomenon is a function of the *contexts* that academics have to navigate rather than being a symptom of inherent psychological vulnerabilities. This is a critical step forward in our understanding of this phenomenon.

In addition, the finding that gender differences in impostor feelings in brilliance-oriented fields were largest among URM academics underscores the value of an intersectional approach



to studying the impostor phenomenon. URM women pursuing brilliance-oriented fields seem to experience a distinct, heightened form of oppression that emerges at the confluence of their identities. This result is consistent with others suggesting, for example, that URM women experience stronger stereotype threat in the intellectual domain than either White women or URM men (Gonzales et al., 2002). In fact, the impostor feelings reported by URM men in our sample did not vary as a function of their field's brilliance emphasis (see Figure 3). This result may be due in part to the more traditional masculinity norms that are sometimes found among Black and Latino men (e.g., Arciniega et al., 2008; Levant et al., 1998), which are incompatible with expressing doubts about their abilities. Overall, these results illustrate an important point made by Purdie-Vaughns and Eibach (2008): Individuals with single vs. multiple marginalized identities may experience qualitatively, not just quantitatively, different forms of oppression.

It is noteworthy, however, that this intersectional pattern emerged only when we predicted impostor feelings on the basis of academics' *own* perceptions of the extent to which their field values brilliance. When we used the perceptions of their colleagues instead, the results were more compatible with an additive pattern: With increasing emphasis on brilliance, the gender differences in impostor feelings increased to a similar extent for URM and White and Asian academics (rather than increasing disproportionately for URM academics). What explains this discrepancy? One possibility is that the analysis with field-level scores was underpowered to detect this three-way interaction (field-level  $N = 49$ ; individual-level  $N > 4600$ ). As a result, even though the magnitude of the coefficient for the three-way interaction was nearly identical in the models with field-averaged and respondent-specific scores ( $bs = 0.31$  and  $0.32$ , respectively), the former model had substantially lower power to detect a significant effect. A second possibility is suggested by comparing the relationship between a field's brilliance orientation and impostor feelings for *URM men* across these two models. In the model with respondents' own perceptions of their field's brilliance orientation, these perceptions showed a non-significant *negative* relationship with URM men's impostor feelings ( $b = -0.11$ ). In contrast,

the field-averaged perceptions showed a non-significant *positive* relationship with URM men's impostor feelings ( $b = 0.30$ ). This now-positive relationship decreased the magnitude of estimated gender gaps among URM participants in brilliance-oriented fields, rendering this difference more similar to the gender difference among White and Asian participants, hence the null three-way interaction. But why did the sign of this relationship flip for URM men? If, as we speculated before, this subgroup of academics adheres to a relatively strict set of masculinity norms (e.g., Arciniega et al., 2008), this may lead them to avoid self-reporting *both* that they perceive their field to value brilliance *and* that they feel like impostors; reporting high values on both of these dimensions could be perceived as incompatible with the norm of projecting confidence and ability. Such a response tendency would suppress the magnitude of the relationship between these two measures or even lead them to be *inversely* related. However, URM men's colleagues' (aggregated) perceptions of their field's brilliance orientation are not subject to the same impression management concerns, which is perhaps why they were better able to predict URM men's reported impostor feelings. At this point, however, this explanation is speculative, so we welcome future research that might bear on its accuracy.

In line with prior work (e.g., Vaughn et al., 2020), our findings also revealed that junior academics (graduate students and postdoctoral fellows) experience stronger impostor feelings than faculty. One potential explanation for this pattern is that academics' impostor feelings decrease over time as they gain more certainty about the source of their achievements and become more confident in their ability to succeed in future endeavors. A complementary possibility is that this pattern (also) reflects survivorship bias: Those academics who seldom feel like impostors persist in academia and eventually secure faculty positions in their field, whereas academics who often feel like impostors early on eventually depart their fields and are therefore not represented in our data. To disentangle these two possibilities, future work might employ longitudinal designs that track academics from the beginning of their career until they secure long-term employment (e.g., Bernard et al., 2017).

More pertinent to our aims here, although the differences in impostor feelings between junior and senior academics were significant regardless of their fields' perceived brilliance orientation, these differences were larger in fields thought to value brilliance for success. This result emerged because faculty members' impostor feelings did not vary with their perceptions of their field's brilliance orientation, whereas more junior academics' did: Their impostor feelings were stronger when they perceived their field to value brilliance (see Figure 2). However, it is interesting to note that a field's brilliance orientation moderated the magnitude of career-stage differences in impostor feelings only when academics' *own* perceptions of their field's brilliance orientation served as the predictor—when we instead used field-level aggregates of these perceptions as the predictor, a field's brilliance orientation no longer moderated the difference in impostor feelings between junior and senior academics (see Table S8). In these models, faculty, like graduate students and postdocs, reported stronger impostor feelings in fields that (their colleagues perceived to) prize brilliance: That is, the more that *others* in their field believed brilliance to be a requirement for success, the more that faculty in that field felt like impostors. Because others' perceptions of their field's brilliance orientation also predicted impostor feelings among women and junior academics, these findings highlight the importance of a field's *climate* for academics' psychological well-being.

Another distinct contribution of this work is the evidence that academics who perceive themselves as impostors are also likely to think that they are not valued by the community of their field (belonging) and that they are unlikely to conquer future challenges in their careers (self-efficacy). Given that belonging and self-efficacy are key factors that predict performance, productivity, and career choice (e.g., Lauermann et al., 2017; Yeager et al., 2016), these findings suggest that experiencing impostor feelings could represent a significant barrier to long-term success in academia.

We emphasize that the argument here is about success *in the long term*—over the course of one's career. In the short term, feelings of being an impostor may not relate

systematically to success or may even be *positively* correlated with it because the concerns that accompany the impostor phenomenon might prompt additional effort and preparation. Indeed, impostor feelings sometimes show a positive (but weak) correlation with GPA (Cokley et al., 2015; King & Cooley, 1995; but see Bernard et al., 2002; Lige et al., 2017). However, despite these apparent benefits, the cumulative toll of feeling like an intellectual fraud in one's chosen profession is likely to increase with time and ultimately undermine academics' well-being and success (Clance, 1985a; Clance & Imes, 1978). While this claim may appear to be in tension with our finding that faculty members experience particularly *low* levels of impostor feelings, it is important to keep in mind that many academics who experience intense impostor feelings early in their careers are likely to select other career paths and are thus not among the faculty in this sample. In other words, the faculty's showing low levels of impostor feelings is not inconsistent with the claim that feeling like an impostor undermines academics' well-being and success in the long term. A fruitful avenue for future research would be to investigate exactly how the downstream consequences of impostor feelings manifest among people pursuing academic careers. For instance, constant doubts about one's ability could result in lower mentorship or teaching effectiveness (e.g., Brems et al., 1994), reduced research productivity (e.g., Phillips & Russel, 1994), or lower likelihood of seeking job opportunities, promotions, and awards.

### **Limitations and Future Directions**

This study has several limitations. First, the data are correlational, which necessarily limits the conclusions we can draw from our results. We cannot claim to have shown that a field's emphasis on brilliance *causes* (differences in) academics' impostor feelings. Although previous experimental studies have demonstrated that messages about brilliance undermine women's belonging and interest (Bian, Leslie, Murphy, & Cimpian, 2018), additional work will be needed to establish a causal link between messages about brilliance and impostor feelings. Likewise, we cannot claim to have shown that impostor feelings *precede* or *prompt* a lower sense of belonging or lower self-efficacy. It is possible that belonging and self-efficacy shape

impostor feelings instead, or that these feelings manifest in a cyclical pattern. The possibility of a reciprocal relationship represents an important consideration in designing interventions to improve academics' psychological experiences: Aiming to improve any one of these three dimensions (belonging, self-efficacy, or impostor feelings) may have positive downstream consequences for the other two.

A second limitation is that we did not use a probability sample of U.S. academics. Although the present sample was large and was recruited from a set of nine universities that were geographically diverse and that included both public and private institutions, the generalizability of these results to U.S. academics as a population nevertheless awaits further investigation. Our check for the possibility of differential non-response across subgroups of respondents suggested that the results are generally robust to this form of selection bias (see Appendix S3), but the possibility of bias remains nevertheless. We look forward to future research on this topic that uses probability samples constructed to be representative of U.S. academics, as well as samples that can characterize these processes in an international context.

A third limitation is that we examined a single contextual factor (namely, a field's emphasis on brilliance). Although we think that this factor is prevalent and powerful, it is clearly not the only relevant one, and we welcome future work that examines whether other aspects of educational and professional settings (e.g., workload, overt bias and discrimination) are similarly accompanied by heightened impostor feelings among some of their members (e.g., Bernard et al., 2017; Canning et al., 2020).

## **Conclusion**

From our perspective, one of the merits of the present research is that it represents an alternative to pathologizing individuals who experience impostor feelings, pointing instead to how these feelings emerge in individuals with certain backgrounds as a function of exposure to particular contexts (see Feenstra et al., 2020). Because of this shift in focus, we believe these

findings have implications for current recommendations for managing impostor feelings. These recommendations typically focus on how the *individual* can reduce their impostor feelings by modifying their own behaviors and cognitions (e.g., Harvey & Katz, 1985; Hoang, 2013). Our results offer a different conclusion: Brilliance-oriented fields have failed to create an environment in which women, particularly those from groups underrepresented in academia, and early-career academics feel capable of succeeding. Thus, the onus of reducing impostor feelings should be on the fields, not on the academics themselves. Fields that value brilliance as the key to success would be well served by reshaping their narrative on how to succeed. Focusing on the institutional and climate-related factors that are associated with impostor feelings is an important step toward improving people's experiences in academia.

### References

- Arciniega, G. M., Anderson, T. C., Tovar-Blank, Z. G., & Tracey, T. J. (2008). Toward a fuller conception of Machismo: Development of a traditional Machismo and Caballerismo Scale. *Journal of Counseling Psychology, 55*(1), 19-33.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*, 1-48.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497-529.
- Berdahl, J. L., & Moore, C. (2006). Workplace harassment: Double jeopardy for minority women. *Journal of Applied Psychology, 91*(2), 426-436.
- Berg, N. (2005) Non-response bias. In K. Kempf-Leonard (Ed) *Encyclopedia of Social Measurement, vol. 2* (pp. 865–73). London: Academic Press.
- Bernard, D. L., Lige, Q. M., Willis, H. A., Sosoo, E. E., & Neblett, E. W. (2017). Impostor phenomenon and mental health: The influence of racial discrimination and gender. *Journal of Counseling Psychology, 64*(2), 155-166.
- Bernard, N. S., Dollinger, S. J., & Ramaniah, N. V. (2002). Applying the big five personality factors to the impostor phenomenon. *Journal of Personality Assessment, 78*(2), 321-333.
- Bian, L., Leslie, S. J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science, 355*(6323), 389-391.
- Bian, L., Leslie, S. J., & Cimpian, A. (2018). Evidence of bias against girls and women in

- contexts that emphasize intellectual ability. *American Psychologist*, 73(9), 1139-1153.
- Bian, L., Leslie, S. J., Murphy, M. C., & Cimpian, A. (2018). Messages about brilliance undermine women's interest in educational and professional opportunities. *Journal of Experimental Social Psychology*, 76, 404-420.
- Brems, C., Baldwin, M. R., Davis, L., & Namynuik, L. (1994). The imposter syndrome as related to teaching evaluations and advising relationships of university faculty members. *Journal of Higher Education*, 65(2), 183-193.
- Canning, E. A., LaCosse, J., Kroeper, K.M., & Murphy, M. C. (2020). Feeling like an imposter: The effect of perceived classroom competition on the daily psychological experiences of first-generation college students. *Social Psychological and Personality Science*, 11(5), 647-657.
- The Carnegie Classification of Institutions of Higher Education (n.d.). *About Carnegie Classification*. Retrieved from <http://carnegieclassifications.iu.edu/>.
- Chen, G., Gully, S. M., & Eden, D. (2001). Validation of a new general self-efficacy scale. *Organizational Research Methods*, 4(1), 62-83.
- Cheryan, S., Plaut, V. C., Davies, P. G., & Steele, C. M. (2009). Ambient belonging: how stereotypical cues impact gender participation in computer science. *Journal of Personality and Social Psychology*, 97(6), 1045-1060.
- Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin*, 143(1), 1-35.
- Chrisman, S. M., Pieper, W. A., Clance, P. R., Holland, C. L., & Glickauf-Hughes, C. (1995). Validation of the Clance Imposter Phenomenon Scale. *Journal of Personality Assessment*, 65(3), 456-467.
- Clance, P. R. (1985a). *The impostor phenomenon: Overcoming the fear that haunts your success* (Vol. 209). Atlanta, GA: Peachtree Publishers.
- Clance, P. R. (1985b). *The impostor phenomenon: When success makes you feel like a fake*.



New York: Bantam Books.

- Clance, P. R., & Imes, S. A. (1978). The imposter phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice*, 15(3), 241-247.
- Cokley, K., Awad, G. H., Smith, L., Jackson, S., Awosogba, O., Hurst, A., Stone-Sabali, S., Blondeau, L., & Roberts, D. (2015). The roles of gender stigma consciousness, imposter phenomenon and academic self-concept in the academic outcomes of women and men. *Sex Roles*, 73, 414-426.
- Cokley, K., Smith, L., Bernard, D., Hurst, A., Jackson, S., Stone, S., Awosogba, O., Saucer, C., Bailey, M., & Roberts, D. (2017). Impostor feelings as a moderator and mediator of the relationship between perceived discrimination and mental health among racial/ethnic minority college students. *Journal of Counseling Psychology*, 64(2), 141-154.
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241-1299.
- Depaoli, S., Lai, K., & Yang, Y. (2020). Bayesian model averaging as an alternative to model selection for multilevel models. *Multivariate Behavioral Research*, 1-21.
- Feenstra, S., Begeny, C. T., Ryan, M. K., Rink, F. A., Stoker, J. I., & Jordan, J. (2020). Contextualizing the impostor "syndrome". *Frontiers in Psychology*, 11, 3206.
- Fox, J., & Hong, J. (2009). Effect displays in R for multinomial and proportional-odds logit models: Extensions to the effects package. *Journal of Statistical Software*, 32(1), 1-24.
- French, B. F., Ullrich-French, S. C., & Follman, D. (2008). The psychometric properties of the Clance Imposter Scale. *Personality and Individual Differences*, 44(5), 1270-1278.
- Ghavami, N., & Peplau, L. A. (2013). An intersectional analysis of gender and ethnic stereotypes: Testing three hypotheses. *Psychology of Women Quarterly*, 37(1), 113-127.
- Gonzales, P. M., Blanton, H., & Williams, K. J. (2002). The effects of stereotype threat and double-minority status on the test performance of Latino women. *Personality and Social*

- Psychology Bulletin*, 28(5), 659-670.
- Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology*, 102(4), 700-717.
- Harvey, J. C., & Katz, C. (1985). *If I'm so successful, why do I feel like a fake? The impostor phenomenon*. New York: St. Martin's Press.
- Hausmann, L. R., Schofield, J. W., & Woods, R. L. (2007). Sense of belonging as a predictor of intentions to persist among African American and White first-year college students. *Research in Higher Education*, 48(7), 803-839.
- Hinne, M., Gronau, Q. F., van den Bergh, D., & Wagenmakers, E.-J. (2020). A conceptual introduction to Bayesian model averaging. *Advances in Methods and Practices in Psychological Science*, 3(2), 200-215.
- Hoang, Q. (2013). The impostor phenomenon: Overcoming internalized barriers and recognizing achievements. *The Vermont Connection*, 34(1), 42-51.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179-185.
- Hox, J. J., Moerbeek, M., & Van de Schoot, R. (2018). *Multilevel analysis: Techniques and applications*. New York: Routledge.
- Ito, T.A., & McPherson, E. (2018). Factors influencing high school students' interest in pSTEM. *Frontiers in Psychology*, 9, 1535.
- Ivie, R., White, S., & Chu, R. Y. (2016). Women's and men's career choices in astronomy and astrophysics. *Physical Review Physics Education Research*, 12(2), 020109.
- Jaxon, J., Lei, R. F., Shachnai, R., Chestnut, E. K., & Cimpian, A. (2019). The acquisition of gender stereotypes about intellectual ability: Intersections with race. *Journal of Social Issues*, 75(4), 1192-1215.
- Johnson, P. O., & Fay, L. C. (1950). The Johnson-Neyman technique, its theory and

- application. *Psychometrika*, 15(4), 349-367.
- Jöstl, G., Bergsmann, E., Lüftenegger, M., Schober, B., & Spiel, C. (2015). When will they blow my cover? *Zeitschrift für Psychologie*, 220(2), 109-120.
- Juan, M. J. D., Syed, M., & Azmitia, M. (2016). Intersectionality of race/ethnicity and gender among women of color and White women. *Identity: An International Journal of Theory and Research*, 16(4), 225-238.
- Ketray, L., Clance, P. R., & Holland, C. L. (1992). *A factor study of the Clance Impostor Phenomenon Scale*. Unpublished manuscript. Atlanta, GA: Georgia State University.
- King, J. E., & Cooley, E. L. (1995). Achievement orientation and the impostor phenomenon among college students. *Contemporary Educational Psychology*, 20(3), 304-312.
- Kumar, S., & Jagacinski, C. M. (2006). Imposters have goals too: The impostor phenomenon and its relationship to achievement goal theory. *Personality and Individual Differences*, 40(1), 147-157.
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2014). *Package "lmerTest"*. Retrieved from <http://cran.uib.no/web/packages/lmerTest/lmerTest.pdf>
- Lauermann, F., Tsai, Y. M., & Eccles, J. S. (2017). Math-related career aspirations and choices within Eccles et al.'s expectancy–value theory of achievement-related behaviors. *Developmental Psychology*, 53(8), 1540-1559.
- LeBreton, J. M., & Senter, J. L. (2008). Answers to 20 questions about interrater reliability and interrater agreement. *Organizational Research Methods*, 11(4), 815-852.
- Leeper, T. J. (2018). *Margins: Marginal effects for model objects*. R package version 0.3.23.
- Leslie, S. J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science*, 347(6219), 262-265.
- Levant, R. F., Majors, R. G., & Kelley, M. L. (1998). Masculinity ideology among young African American and European American women and men in different regions of the United States. *Cultural Diversity and Mental Health*, 4(3), 227-236.

- Lige, Q. M., Peteet, B. J., & Brown, C. M. (2017). Racial identity, self-esteem, and the impostor phenomenon among African American college students. *Journal of Black Psychology*, 43(4), 345-357.
- Long, J. A. (2019). *Interactions: Comprehensive user-friendly toolkit for probing interactions* (Version 1.0). Retrieved from <https://cran.r-project.org/package=interactions>
- Lüdtke, O., Robitzsch, A., Trautwein, U., & Kunter, M. (2009). Assessing the impact of learning environments: How to use student ratings of classroom or school characteristics in multilevel modeling. *Contemporary Educational Psychology*, 34(2), 120-131.
- Maslow, A. H. (1968). *Toward a psychology of being*. New York: Van Nostrand.
- Meyer, M., Cimpian, A., & Leslie, S. J. (2015). Women are underrepresented in fields where success is believed to require brilliance. *Frontiers in Psychology*, 6, 235.
- Muenks, K., Canning, E. A., LaCosse, J., Green, D. J., Zirkel, S., Garcia, J. A., & Murphy, M. C. (2020). Does my professor think my ability can change? Students' perceptions of their STEM professors' mindset beliefs predict their psychological vulnerability, engagement, and performance in class. *Journal of Experimental Psychology: General*, 149(11), 2119–2144.
- Murphy, M. C., Kroeper, K. M., & Ozier, E. M. (2018). Prejudiced places: How contexts shape inequality and how policy can change them. *Policy Insights from the Behavioral and Brain Sciences*, 5(1), 66-74.
- Pajares, F. (1996). Self-efficacy beliefs and mathematical problem-solving of gifted students. *Contemporary Educational Psychology*, 21(4), 325-344.
- Pajares, F., & Johnson, M. J. (1996). Self-efficacy beliefs and the writing performance of entering high school students. *Psychology in the Schools*, 33(2), 163-175.
- Phillips, J. C., & Russell, R. K. (1994). Research self-efficacy, the research training environment, and research productivity among graduate students in counseling psychology. *The Counseling Psychologist*, 22(4), 628-641.

- Pittman, L. D., & Richmond, A. (2007). Academic and psychological functioning in late adolescence: The importance of school belonging. *The Journal of Experimental Education, 75*(4), 270-290.
- Peteet, B. J., Montgomery, L., & Weekes, J. C. (2015). Predictors of imposter phenomenon among talented ethnic minority undergraduate students. *The Journal of Negro Education, 84*(2), 175-186.
- Purdie-Vaughns, V., & Eibach, R. P. (2008). Intersectional invisibility: The distinctive advantages and disadvantages of multiple subordinate-group identities. *Sex Roles, 59*, 377-391.
- Schmader, T., & Hall, W. M. (2014). Stereotype threat in school and at work: Putting science into practice. *Policy Insights from the Behavioral and Brain Sciences, 1*(1), 30–37.
- Schunk, D. H. (1984). Self-efficacy perspective on achievement behavior. *Educational Psychologist, 19*(1), 48-58.
- Schunk, D. H. (1989). Self-efficacy and achievement behaviors. *Educational Psychology Review, 1*(3), 173-208.
- Simon, M., & Choi, Y. J. (2018). Using factor analysis to validate the Clance Impostor Phenomenon Scale in sample of science, technology, engineering and mathematics doctoral students. *Personality and Individual Differences, 121*, 173-175.
- Storage, D., Charlesworth, T. E. S., Banaji, M. R., & Cimpian, A. (2020). Adults and children implicitly associate brilliance with men more than women. *Journal of Experimental Social Psychology, 90*, 104020.
- Storage, D., Horne, Z., Cimpian, A., & Leslie, S. J. (2016). The frequency of “brilliant” and “genius” in teaching evaluations predicts the representation of women and African Americans across fields. *PLOS ONE, 11*(3), e0150194.
- Vaughn, A. R., Taasoobshirazi, G., & Johnson, M. L. (2020). Impostor phenomenon and motivation: Women in higher education. *Studies in Higher Education, 45*(4), 1-16.

Walton, G. M., Cohen, G. L., Cwir, D., & Spencer, S. J. (2012). Mere belonging: The power of social connections. *Journal of Personality and Social Psychology*, 102(3), 513-532.

Yeager, D. S., Walton, G. M., Brady, S. T., Akcinar, E. N., Paunesku, D., Keane, L., ... & Gomez, E. M. (2016). Teaching a lay theory before college narrows achievement gaps at scale. *Proceedings of the National Academy of Sciences*, 113(24), E3341-E3348.

## Tables and Figures

Table 1  
*The Four Measures Administered in the Survey*

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### Impostor Phenomenon<sup>a</sup>

When people praise me for something I've accomplished, I'm afraid I won't be able to live up to their expectations of me in the future.

I'm afraid people important to me may find out that I'm not as capable as they think I am.

Sometimes I'm afraid others will discover how much knowledge or ability I really lack.

When I've succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success.

I often worry about not succeeding with a project, even though others around me have considerable confidence that I will do well.

### Belonging

I feel like I am part of the community of my field.

I feel a connection with other members of my field.

I feel accepted by other members of my field.

I feel respected by other members of my field.

I feel valued by other members of my field.

I feel comfortable around other members of my field.

I feel nervous around other members of my field. (R)

I feel inadequate around other members of my field. (R)

### Self-efficacy

When facing difficult tasks in my field, I am certain that I will accomplish them.

I believe I can succeed at almost any professional endeavor to which I set my mind.

I am confident that I can perform effectively on many different professional tasks.

Compared to other people in my field, I can do most tasks very well.

I feel confident about my ability in my field.

### Field-specific Ability Beliefs (Brilliance Orientation)<sup>b</sup>

Personally, I think that being a top scholar of [my discipline] requires a special aptitude that just can't be taught.<sup>c</sup>

Personally, I think that if you want to succeed in [my discipline], hard work alone just won't cut it; you need to have an innate gift or talent.

Personally, I think that with the right amount of effort and dedication, anyone can be a top scholar of [my discipline].<sup>c</sup> (R)

Personally, I think that when it comes to [my discipline], the most important factors for success are motivation and sustained effort; raw ability is secondary. (R)

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*Note.* Participants were asked to rate their agreement with these items on a scale from 1 to 7. Response options were (1) Strongly Disagree, (2) Disagree, (3) Somewhat Disagree, (4) Neither Agree Nor Disagree, (5) Somewhat Agree, (6) Agree, and (7) Strongly Agree. (R) indicates that the item was reverse scored.

<sup>a</sup> From *The Impostor Phenomenon: When Success Makes You Feel Like A Fake* (pp. 20-22), by P.R. Clance (1985b), Toronto: Bantam Books. Copyright 1985 by Pauline Rose Clance. Reprinted by permission. Do not reproduce without permission from Pauline Rose Clance, [drpaulinerose@comcast.net](mailto:drpaulinerose@comcast.net).

<sup>b</sup> Participants also saw the four items prefaced with "Other academics in [my discipline] tend to think that..." Thus, participants rated a total of eight items.

<sup>c</sup> Participants who indicated that their primary affiliation was medical at the beginning of the survey read this item with the word "performer" instead of "scholar."

Table 2

*Means, SDs, and bivariate correlations among impostor phenomenon, belonging, self-efficacy, and field-specific ability beliefs*

	<i>M (SD)</i>	1.	2.	3.	4.
1. Impostor Phenomenon	4.01 (1.66)	—			
2. Belonging	4.97 (1.14)	-.46***	—		
3. Self-efficacy	5.23 (1.11)	-.54***	.51***	—	
4. Field-specific Ability Beliefs	3.88 (0.98)	.03†	-.11***	-.10***	—

*Note.*  $n = 4799$  to  $4870$  academics. Possible range for means is 1–7. †  $p < .10$ . \*\*\*  $p < .001$ .



Table 3

Mixed-effects model predicting **impostor phenomenon** from FAB (higher = stronger emphasis on brilliance), gender (0 = man, 1 = woman), career stage (0 = graduate student or postdoc, 1 = faculty), URM status (0 = White or Asian, 1 = underrepresented minority), and all possible interactions

	<b>Model 1</b> ( <i>n</i> = 4608, <i>n</i> <sub>field</sub> = 83)				<b>Model 2</b> (adjust for % women and URMs, <i>n</i> = 4496, <i>n</i> <sub>field</sub> = 68)				<b>Model 3</b> (post-stratification weights, <i>n</i> = 4397, <i>n</i> <sub>field</sub> = 52)			
<i>Fixed effects</i>	<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>	
(Intercept)	4.04***	0.03	3.98	4.10	4.01***	0.03	3.95	4.08	4.02***	0.03	3.95	4.08
FAB	0.12***	0.02	0.08	0.17	0.12***	0.02	0.08	0.17	0.13***	0.03	0.08	0.19
Female	0.42***	0.05	0.31	0.52	0.43***	0.05	0.33	0.54	0.36***	0.07	0.22	0.49
Faculty	-1.24***	0.05	-1.34	-1.15	-1.24***	0.05	-1.34	-1.15	-1.22***	0.05	-1.32	-1.12
URM	0.14†	0.07	0.00	0.29	0.17*	0.08	0.02	0.31	0.12	0.08	-0.04	0.28
FAB × Female	0.13**	0.05	0.04	0.22	0.13**	0.05	0.04	0.22	0.15**	0.05	0.04	0.26
FAB × Faculty	-0.20***	0.05	-0.29	-0.11	-0.20***	0.05	-0.29	-0.11	-0.20***	0.05	-0.29	-0.10
Female × Faculty	-0.13	0.09	-0.32	0.05	-0.11	0.10	-0.30	0.07	-0.05	0.10	-0.25	0.15
FAB × URM	-0.03	0.08	-0.18	0.12	-0.03	0.08	-0.18	0.12	-0.13	0.09	-0.30	0.04
Female × URM	0.20	0.15	-0.09	0.49	0.19	0.15	-0.10	0.49	0.07	0.16	-0.25	0.39
Faculty × URM	0.16	0.16	-0.14	0.47	0.15	0.16	-0.16	0.46	0.27†	0.16	-0.04	0.58
FAB × Female × Faculty	0.16†	0.09	-0.03	0.34	0.13	0.09	-0.05	0.32	0.16	0.10	-0.04	0.35
FAB × Female × URM	0.32*	0.15	0.02	0.62	0.31*	0.15	0.01	0.62	0.27	0.17	-0.07	0.61
FAB × Faculty × URM	0.14	0.16	-0.18	0.45	0.15	0.16	-0.17	0.47	-0.07	0.17	-0.41	0.26
Female × Faculty × URM	-0.12	0.31	-0.73	0.49	-0.19	0.32	-0.81	0.43	-0.60†	0.32	-1.22	0.02
FAB × Female × Faculty × URM	0.09	0.32	-0.54	0.73	0.05	0.33	-0.59	0.69	0.29	0.34	-0.38	0.95
% Women					0.00	0.00	0.00	0.01				
% URM					-0.03**	0.01	-0.04	-0.01				
% Women × % URM					0.00	0.00	0.00	0.00				
<i>Random effects</i>	<i>Variance</i>				<i>Variance</i>				<i>Variance</i>			
Field intercept	0.02				0.01				0.02			
Female slope	0.02				0.02				0.08			

*Note.* All predictors were mean-centered. Models included a random intercept for field and an uncorrelated random slope for gender. Model 1 summarizes results of the “main model” as referenced in the text. Model 2 adjusts for the percentage of women and URMs in each field. Model 3 uses post-stratification weights to account for non-response bias. FAB = field-specific ability beliefs. URM = underrepresented minority. †  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 4

Mixed-effects model predicting **belonging** from impostor phenomenon (IP; higher = stronger impostor phenomenon), gender (0 = man, 1 = woman), career stage (0 = graduate student or postdoc, 1 = faculty), URM status (0 = white or Asian, 1 = underrepresented minority), and all possible interactions

	Model 1 ( $n = 4610$ , $n_{\text{field}} = 83$ )				Model 2 (adjust for % women and URMs, $n = 4498$ , $n_{\text{field}} = 68$ )				Model 3 (post-stratification weights, $n = 4399$ , $n_{\text{field}} = 52$ )			
<i>Fixed effects</i>	<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>	
(Intercept)	5.01***	0.03	4.95	5.07	5.01***	0.04	4.94	5.08	5.02***	0.04	4.94	5.09
IP	-0.27***	0.01	-0.29	-0.26	-0.27***	0.01	-0.29	-0.25	-0.27***	0.01	-0.30	-0.25
Female	-0.05	0.03	-0.11	0.02	-0.05	0.03	-0.11	0.02	-0.09*	0.04	-0.16	-0.01
Faculty	0.23***	0.03	0.16	0.30	0.23***	0.04	0.16	0.30	0.20***	0.04	0.13	0.27
URM	-0.09†	0.05	-0.19	0.01	-0.10†	0.05	-0.20	0.01	-0.10†	0.06	-0.21	0.01
IP × Female	0.03	0.02	-0.01	0.07	0.02	0.02	-0.01	0.06	0.02	0.02	-0.03	0.06
IP × Faculty	-0.02	0.02	-0.06	0.02	-0.01	0.02	-0.05	0.03	-0.01	0.02	-0.05	0.03
Female × Faculty	0.00	0.07	-0.13	0.13	-0.01	0.07	-0.14	0.12	-0.07	0.07	-0.20	0.07
IP × URM	0.02	0.03	-0.03	0.08	0.03	0.03	-0.03	0.09	0.04	0.03	-0.02	0.11
Female × URM	-0.02	0.10	-0.22	0.18	-0.01	0.10	-0.22	0.19	0.02	0.11	-0.20	0.23
Faculty × URM	0.01	0.11	-0.20	0.22	0.01	0.11	-0.21	0.22	-0.02	0.11	-0.23	0.19
IP × Female × Faculty	0.01	0.04	-0.06	0.09	0.02	0.04	-0.06	0.10	-0.01	0.04	-0.09	0.07
IP × Female × URM	-0.06	0.06	-0.17	0.05	-0.05	0.06	-0.16	0.07	-0.05	0.06	-0.17	0.08
IP × Faculty × URM	0.04	0.06	-0.08	0.16	0.05	0.06	-0.08	0.17	0.06	0.06	-0.06	0.18
Female × Faculty × URM	-0.26	0.21	-0.68	0.16	-0.24	0.22	-0.67	0.19	-0.31	0.21	-0.73	0.11
IP × Female × Faculty × URM	-0.01	0.12	-0.25	0.23	0.02	0.12	-0.22	0.26	0.02	0.12	-0.22	0.27
% Women					0.00	0.00	-0.01	0.00				
% URM					0.00	0.01	-0.01	0.02				
% Women × % URM					0.00	0.00	0.00	0.00				
<i>Random effect</i>	<i>Variance</i>				<i>Variance</i>				<i>Variance</i>			
Field intercept	0.03				0.04				0.05			

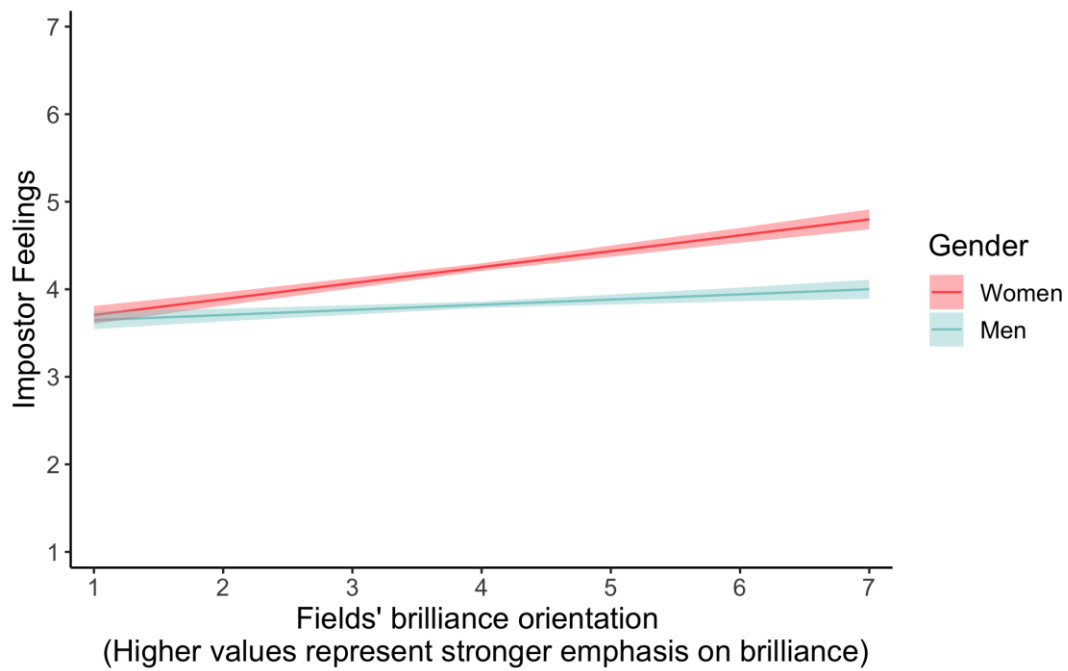
*Note.* All predictors were mean-centered. Models included a random intercept for field. Model 1 summarizes results presented in the text. Model 2 adjusts for the percentage of women and URMs in each field. Model 3 uses post-stratification weights to account for non-response bias. IP = impostor phenomenon. URM = underrepresented minority. †  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 5

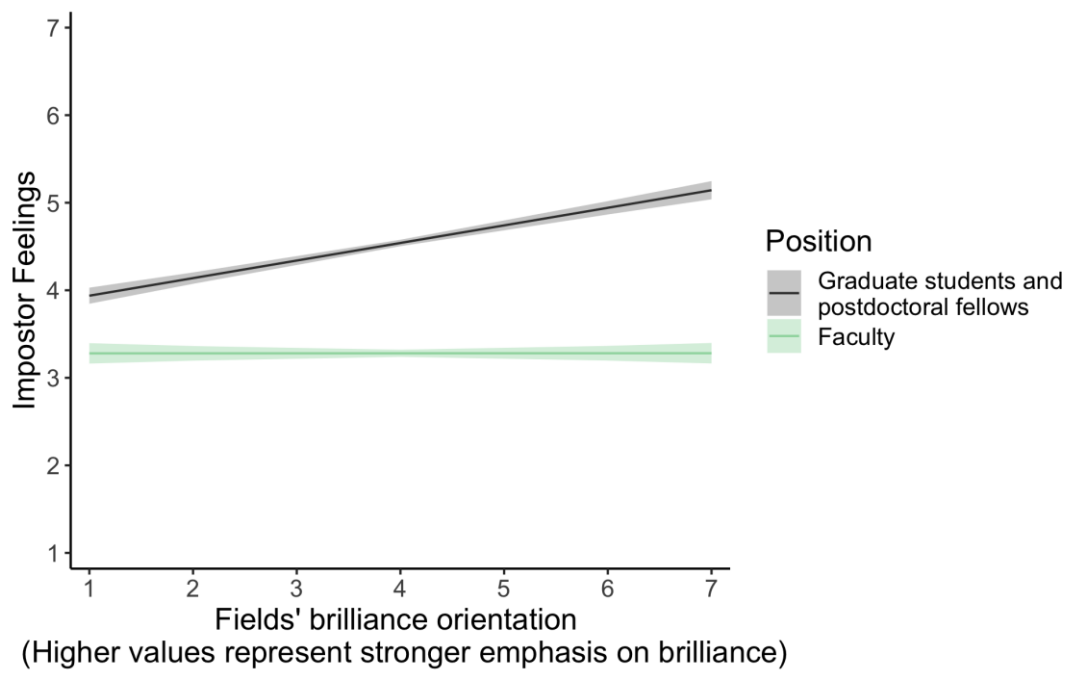
Mixed-effects model predicting **self-efficacy** from impostor phenomenon (higher = stronger impostor phenomenon), gender (0 = man, 1 = woman), career stage (0 = graduate student or postdoc, 1 = faculty), URM status (0 = White or Asian, 1 = underrepresented minority), and all possible interactions

	Model 1 ( $n = 4610$ , $n_{\text{field}} = 83$ )				Model 2 (adjust for % women and URMs, $n = 4498$ , $n_{\text{field}} = 68$ )				Model 3 (post-stratification weights, $n = 4399$ , $n_{\text{field}} = 52$ )			
<i>Fixed effects</i>	<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>		<i>b</i>	<i>SE</i>	<i>95% CI</i>	
(Intercept)	5.30***	0.03	5.24	5.36	5.28***	0.03	5.22	5.35	5.29***	0.03	5.23	5.35
IP	-0.33***	0.01	-0.34	-0.31	-0.33***	0.01	-0.34	-0.31	-0.32***	0.01	-0.34	-0.30
Female	-0.01	0.03	-0.07	0.05	-0.01	0.03	-0.07	0.05	-0.02	0.03	-0.08	0.04
Faculty	0.26***	0.03	0.20	0.32	0.27***	0.03	0.20	0.33	0.28***	0.03	0.22	0.34
URM	0.12**	0.05	0.03	0.22	0.13**	0.05	0.04	0.22	0.13**	0.05	0.04	0.23
IP × Female	0.02	0.02	-0.02	0.05	0.02	0.02	-0.02	0.05	0.03†	0.02	0.00	0.07
IP × Faculty	0.05**	0.02	0.01	0.08	0.05*	0.02	0.01	0.08	0.04*	0.02	0.01	0.08
Female × Faculty	0.08	0.06	-0.03	0.20	0.09	0.06	-0.03	0.21	0.11†	0.06	-0.01	0.22
IP × URM	-0.01	0.03	-0.06	0.04	-0.01	0.03	-0.06	0.04	-0.01	0.03	-0.07	0.04
Female × URM	0.08	0.09	-0.10	0.27	0.09	0.09	-0.09	0.27	0.08	0.10	-0.10	0.27
Faculty × URM	0.17†	0.10	-0.02	0.36	0.16	0.10	-0.04	0.35	0.16†	0.09	-0.02	0.34
IP × Female × Faculty	-0.02	0.04	-0.09	0.05	-0.01	0.04	-0.09	0.06	-0.03	0.04	-0.10	0.04
IP × Female × URM	0.09†	0.05	-0.01	0.20	0.08	0.05	-0.02	0.19	0.05	0.06	-0.06	0.16
IP × Faculty × URM	0.04	0.06	-0.07	0.15	0.03	0.06	-0.08	0.14	0.05	0.05	-0.05	0.16
Female × Faculty × URM	-0.29	0.20	-0.67	0.10	-0.28	0.20	-0.67	0.10	-0.46*	0.19	-0.82	-0.09
IP × Female × Faculty × URM	-0.26*	0.11	-0.47	-0.04	-0.25*	0.11	-0.47	-0.03	-0.32**	0.11	-0.54	-0.11
% Women					0.00	0.00	0.00	0.00				
% URM					0.00	0.01	-0.01	0.02				
% Women × % URM					0.00	0.00	0.00	0.00				
<i>Random effect</i>	<i>Variance</i>				<i>Variance</i>				<i>Variance</i>			
Field intercept	0.03				0.03				0.04			

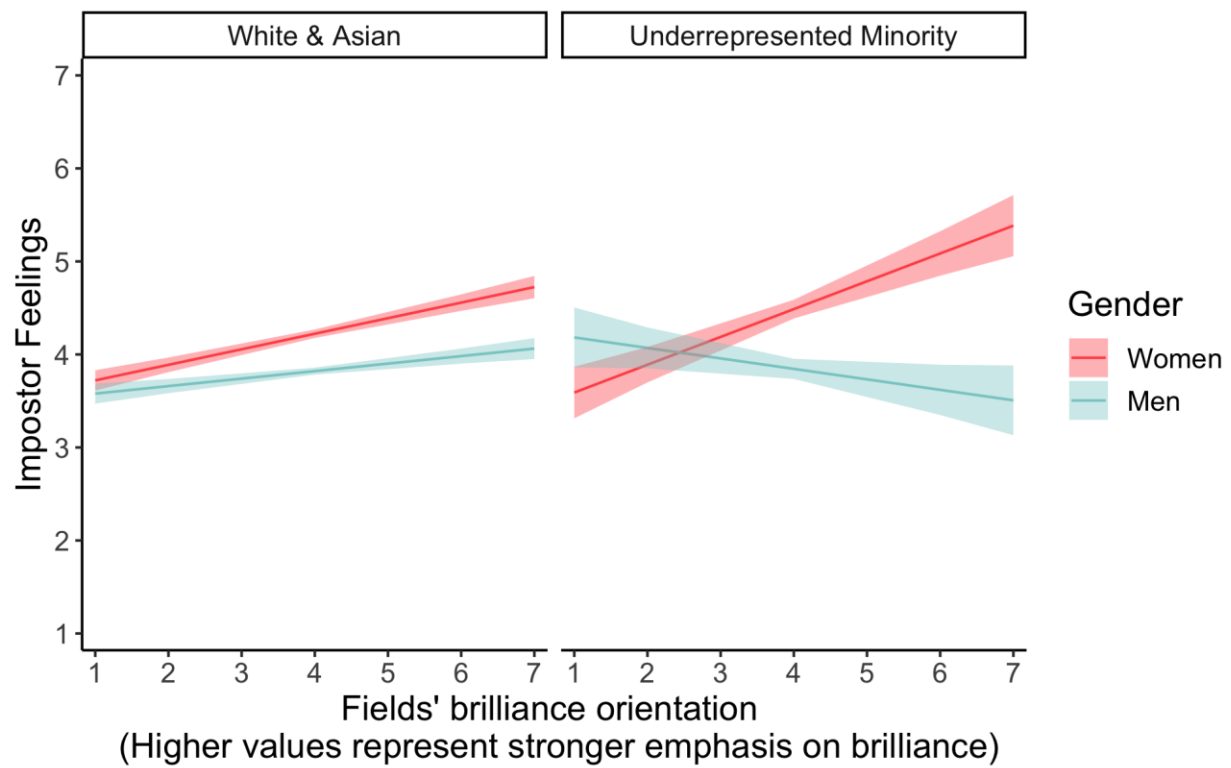
*Note.* All predictors were mean-centered. Models included a random intercept for field. Model 1 summarizes results presented in the text. Model 2 adjusts for the percentage of women and URMs in each field. Model 3 uses post-stratification weights to account for non-response bias. IP = impostor phenomenon. URM = underrepresented minority. †  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



**Figure 1.** The relationship between academics' perceptions that their field values brilliance and their impostor feelings, by gender. Bands represent  $\pm 1$  SE.



**Figure 2.** The relationship between academics' perceptions that their field values brilliance and their impostor feelings, by career stage. Bands represent  $\pm 1$  SE.



**Figure 3.** The relationship between academics' perceptions that their field values brilliance and their impostor feelings, by gender and URM status. Bands represent  $\pm 1 SE$ .